

Amendments to the Claims

This listing of the claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1 (Currently Amended): A full-type rolling bearing formed of an outer ring, an inner ring and rollers that are made of steel, wherein

at least one of said outer ring, inner ring and rollers has a non-diffusible hydrogen content of at most 0.5 ppm, has a carbonitrided layer in its surface layer, and the austenite crystal grain size number of the surface layer is greater than 10, wherein

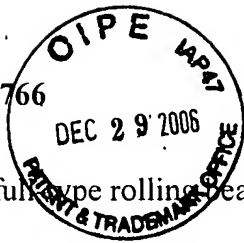
after at least one of said outer ring, inner ring and rollers is carbonitrided at a carbonitriding temperature equal to or higher than the A1 transformation temperature, said at least one of said outer ring, inner ring and rollers is cooled to a temperature lower than the A1 transformation temperature and then heated to a quenching temperature of 790°C - 815°C and thereby quenched.

2 (Canceled)

3 (Previously Presented): The full-type rolling bearing according to claim 1, wherein said quenching temperature is in a temperature range at which carbide and/or nitride and an austenite phase coexist in the carbonitrided surface layer of the steel.

4 (Canceled)

5 (Previously Presented): The full-type rolling bearing according to claim 1, wherein at least one of said outer ring, inner ring and rollers is cold-worked before being carbonitrided.



6 (Original): The full type rolling bearing according to claim 1, wherein  
in at least one of said outer ring, inner ring and rollers, a compression residual stress of at  
least 500 MPa is generated.

7 (Currently Amended): A roller cam follower of an engine comprising:  
an outer ring being in rolling contact with a cam shaft of the engine;  
a roller shaft located inside said outer ring and fixed to a cam follower body; and  
bearing elements placed between said outer ring and said roller shaft, wherein  
at least one of said outer ring, roller shaft and bearing elements has a non-diffusible  
hydrogen content of at most 0.5 ppm, has a carbonitrided layer, and austenite crystal grains in at  
least a surface layer are made fine to have a grain size number greater than 10, wherein  
after at least one of said outer ring, roller shaft, and bearing elements is carbonitrided at a  
carbonitriding temperature equal to or higher than the A1 transformation temperature, said at  
least one of said outer ring, roller shaft and bearing elements is cooled to a temperature lower  
than the A1 transformation temperature and then heated to a quenching temperature of 790°C -  
815°C and thereby quenched.

8 (Currently Amended): A roller cam follower of an engine comprising:  
an outer ring being in rolling contact with a cam shaft of the engine;  
a roller shaft located inside said outer ring and fixed to a cam follower body; and  
bearing elements placed between said outer ring and said roller shaft, wherein  
at least one of said outer ring, roller shaft and bearing elements has a non-diffusible  
hydrogen content of at most 0.5 ppm, has a carbonitrided layer and has a fracture stress of at  
least 2650 MPa, wherein

after at least one of said outer ring, roller shaft, and bearing elements is carbonitrided at a carbonitriding temperature equal to or higher than the A1 transformation temperature, said at least one of said outer ring, roller shaft and bearing elements is cooled to a temperature lower than the A1 transformation temperature and then heated to a quenching temperature of 790° - 815°C and thereby quenched.

9 (Currently Amended): A roller cam follower of an engine comprising:

an outer ring being in rolling contact with a cam shaft of the engine;

a roller shaft located inside said outer ring and fixed to a cam follower body; and

bearing elements placed between said outer ring and said roller shaft, wherein

at least one of said outer ring, roller shaft and bearing elements has a carbonitrided layer and has a non-diffusible hydrogen content of at most 0.5 ppm, wherein

after at least one of said outer ring, roller shaft, and bearing elements is carbonitrided at a carbonitriding temperature equal to or higher than the A1 transformation temperature, said at least one of said outer ring, roller shaft and bearing elements is cooled to a temperature lower than the A1 transformation temperature and then heated to a quenching temperature of 790° - 815°C and thereby quenched.

10 (Original): The roller cam follower of an engine according to claim 7, wherein

said cam follower body is mounted on one end of a rocker arm, said rocker arm is pivotably attached to a rotational shaft located between said one end and the other end, one end of an open/close valve of said engine abuts on said other end, said cam follower body on said one end has a bifurcated roller supporting portion, and said roller shaft is fixed to said bifurcated roller supporting portion.

11 (Original): The roller cam follower of an engine according to claim 8, wherein said cam follower body is mounted on one end of a rocker arm, said rocker arm is pivotably attached to a rotational shaft located between said one end and the other end, one end of an open/close valve of said engine abuts on said other end, said cam follower body on said one end has a bifurcated roller supporting portion, and said roller shaft is fixed to said bifurcated roller supporting portion.

12 (Original): The roller cam follower of an engine according to claim 9, wherein said cam follower body is mounted on one end of a rocker arm, said rocker arm is pivotably attached to a rotational shaft located between said one end and the other end, one end of an open/close valve of said engine abuts on said other end, said cam follower body on said one end has a bifurcated roller supporting portion, and said roller shaft is fixed to said bifurcated roller supporting portion.

13 (Original): The roller cam follower of an engine according to claim 7, wherein said cam follower body is mounted between one end and the other end of a rocker arm, said roller shaft is fixed in a roller hole extending between two sidewalls of the rocker arm, an end of an open/close valve of said engine abuts on said one end of said rocker arm, and a pivot abuts on said other end.

14 (Original): The roller cam follower of an engine according to claim 8, wherein said cam follower body is mounted between one end and the other end of a rocker arm, said roller shaft is fixed in a roller hole extending between two sidewalls of the rocker arm, an end of an open/close valve of said engine abuts on said one end of said rocker arm, and a pivot abuts on said other end.

15 (Original): The roller cam follower of an engine according to claim 9, wherein said cam follower body is mounted between one end and the other end of a rocker arm, said roller shaft is fixed in a roller hole extending between two sidewalls of the rocker arm, an end of an open/close valve of said engine abuts on said one end of said rocker arm, and a pivot abuts on said other end.

16 (Original): The roller cam follower of an engine according to claim 7, wherein a rocker arm is pivotably attached to a rotational shaft located between one end and the other end of said rocker arm, an end of an open/close valve of said engine abuts on said one end, said other end abuts on one end of an interlocking rod transmitting a stress from said cam, said cam follower body is mounted on the other end of said interlocking rod, said one end and said other end of said interlocking rod being located respectively on said rocker arm and said cam, and said roller shaft is attached to said cam follower body and abuts on said cam.

17 (Original): The roller cam follower of an engine according to claim 8, wherein a rocker arm is pivotably attached to a rotational shaft located between one end and the other end of said rocker arm, an end of an open/close valve of said engine abuts on said one end, said other end abuts on one end of an interlocking rod transmitting a stress from said cam, said cam follower body is mounted on the other end of said interlocking rod, said one end and said other end of said interlocking rod being located respectively on said rocker arm and said cam, and said roller shaft is attached to said cam follower body and abuts on said cam.

18 (Original): The roller cam follower of an engine according to claim 9, wherein a rocker arm is pivotably attached to a rotational shaft located between one end and the other end of said rocker arm, an end of an open/close valve of said engine abuts on said one end, said other end abuts on one end of an interlocking rod transmitting a stress from said cam, said

cam follower body is mounted on the other end of said interlocking rod, said one end and said other end of said interlocking rod being located respectively on said rocker arm and said cam, and said roller shaft is attached to said cam follower body and abuts on said cam.

19 (Original): The roller cam follower of an engine according to claim 7, wherein said bearing elements are full type needle bearings.

20 (Original): The roller cam follower of an engine according to claim 8, wherein said bearing elements are full type needle bearings.

21 (Original): The roller cam follower of an engine according to claim 9, wherein said bearing elements are full type needle bearings.

22 (Original): The roller cam follower of an engine according to claim 7, wherein said roller shaft has its end with a hardness lower than that of its central portion.

23 (Original): The roller cam follower of an engine according to claim 8, wherein said roller shaft has its end with a hardness lower than that of its central portion.

24 (Original): The roller cam follower of an engine according to claim 9, wherein said roller shaft has its end with a hardness lower than that of its central portion.

25 (Original): The roller cam follower of an engine according to claim 7, wherein said roller shaft has its end which is caulked.

26 (Original): The roller cam follower of an engine according to claim 8, wherein said roller shaft has its end which is caulked.

27 (Original): The roller cam follower of an engine according to claim 9, wherein said roller shaft has its end which is caulked.

28 (Original): The roller cam follower of an engine according to claim 7, wherein said cam follower is entirely press-formed.

29 (Original): The roller cam follower of an engine according to claim 8, wherein said cam follower is entirely press-formed.

30 (Original): The roller cam follower of an engine according to claim 9, wherein said cam follower is entirely press-formed.